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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/779,885	02/17/2004	Hans Thomann	PM 2000.010A/4	9638

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EXAMINER	
TAYLOR, VICTOR J	

ART UNIT	PAPER NUMBER
2863	

DATE MAILED: 07/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/779,885	Applicant(s) THOMANN ET AL.	
	Examiner Victor J. Taylor	Art Unit 2863	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 March 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 April 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☒ Other: *Office Action.*.

DETAILED ACTION

Drawings

1. The drawings were received on 4/21/2005 with new figure 5. These drawings are approved.

Response to Arguments

2. Applicant's arguments see the new drawing figure 5, filed 4/21/2005 and the arguments of record for figures 1-4 on page 10 of the response with respect to the objection to the drawings have been fully considered and are persuasive. The objection to the drawings of 9/22/2004 is moot and has been withdrawn.

3. Applicant's arguments, see the amended abstract with the amendments to the specification and the replacement declaration of record, filed 4/21/2005, with respect to the objection to the specification and abstract and the declaration have been fully considered and are persuasive. The objection to the specification and abstract and declaration of 9/22/2004 is moot and has been withdrawn.

4. Applicant's arguments see the amendments to the claims and the argument for the amendments of "computing a frequency dependent characteristic" corrects the antecedent basis objection to the claims that was filed 4/21/2005 with respect to the objection to claims 4-6 and 17-19 under 37 CFR 1.75 (c) and have been fully considered and are persuasive. The objection to claims 4-6 and 17-19 of 9/22/2004 is moot and has been withdrawn.

5. Applicant's arguments see the amendment to the specification and the amendments to the claims filed 4/21/2005 of record with respect to the rejection(s)of

claims 1-24 under 102 (e) have been fully considered and are persuasive have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Leggett et al in U. S. Patent 6,614,360.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) The invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1-24 are rejected under 35 U.S.C. 102(e) as being anticipated by Leggett et al., in US 6,614,360.

<u>With regard to claim 1</u>, Leggett et al., teaches a MWD drilling system with the integrated bottom hole assembly utility bottom hole assemblies 22 containing sensors 199 and transmitter sources 180 in figure 8 measuring parameters of interest that include formation porosity and rock mechanical properties in lines 7 of column 14 and further discloses disclose the limitations for,

a. "Generating a source signal from a bottom hole assemble" in the MWD drilling system 22 of figure 8 and discloses generating a source signal traveling the ray path 190 in figure 8 and in line 43 of column 8, and further discloses the generation of signals 180 by the firing of the transmitter to generate source signals in lines 1-65 of column 13 and column 14 using the BHA 22 in lines 38-43 of figure 8 and,

b. Further discloses the limitation of "detecting at least one receiver signal using said bottom hole assembly" in the drilling system 22 of figure 8 and discloses receiving and detecting a source signal 190 in figure 8 and discloses the receiving of signals using the analog digitized receiver circuits on the subassembly BHA 22 in lines 25-45 of column 12. And,

c. Further discloses the limitation of "computing a frequency dependent characteristic of said at least one receiver signal" in the BHA on the drilling system of figure 8 using the measured composite waveforms in line 62 of column 13 with computations of time correlation techniques and the deconvolution of the composite waveform to obtain the signal frequency component 154 in lines 60-67 of column 13 and in lines 1-10 of column 14 and discloses the downhole computer 50 on the BHA for data processing of the P and S wave components that determine the formation porosity and other parameters of interest are determined and computed in lines 5-10 in column 14. And,

d. Further discloses the limitation of "using said frequency dependent characteristic to estimate a property of a formation in the region of said bottom hole assembly disclosed in using the frequency components and the spreading of the

frequency components as illustrated in "Figure 7a which illustrates the pulse 150 of frequency .phi., plotted as a function of time as indicated by the arrow 151, which is applied to the transmitter 140. There is "spreading" of the frequency components of the transmitted pulse as it enters the borehole and formation as depicted in FIG. 7b. The frequency will be essentially a Gaussian distribution about the applied frequency (.phi.) with limits designated as (.+-..omega.). If for example the selected operating frequency is (.omega.) = 15 kHz, the limits of the frequency distribution might be (.DELTA..omega.) = (.+-.5 kHz.). Figure 7c illustrates the amplitude of a full wave train 154 recorded by the receiver 142 if there were no drilling noise present. The transmitter firing occurs at the time denoted by the numeral 162 and the P, S and tube wave arrivals occur within the time intervals 156, 158 and 160, respectively. In the actual operation of the system, drilling and road noise is present and the wave train actually recorded at the received 142 is depicted by the curve 170 of FIG. 7d. The curve 170 is actually a composite of the wave train 154 depicted in FIG. 7c and is incoherent noise. The excursion 172 illustrates a rather large spike in the drilling noise. Since the waveform 154 contains the basic information of interest from which formation parameters are computed, including the formation porosity the initial processing of the "raw" data curve 170 must include steps for either removing the noise or mathematically "canceling" the noise component. Seismology has addressed a similar problem for many years by algebraically adding or "stacking" a series for wave forms comprising essentially constant signal components and non-coherent noise components. The noise components tend to algebraically cancel as more and more composite wave forms are

stacked leaving only the desired signal component. In MWD operations, a number of composite waveforms measured at essentially the same position within the borehole are stacked thereby leaving only the desired signal component. There are other methods used in the art to remove the noise component. These methods include time correlation techniques and result in the deconvolution of the composite wave form to obtain the signal component 154 and the noise component 174 as illustrated in FIG. 7e. Regardless of the method selected, the composite waveform is first digitized by using the previously mention A/D converters and then transferred to the downhole computer 50 for processing. Processing further includes the determination of the amplitudes and arrival times of the P and S wave components from which formation porosity, rock mechanical properties, and other previously discussed parameters of interest are determined. Once computed, the parameters of interest are transmitter to the surface by using the link telemetry path 27 or stored within the downhole storage 46 for subsequent retrieval." And found in lines 30-65 of column 13.

As to claim 2, Leggett et al., discloses the limitation of the "BHA comprises a MWD drilling apparatus" 22 in the drilling system of figure 8.

As to claim 3, Leggett et al., discloses the limitation of the "BHA emits a noise spectrum generated by a drill bit of said drilling apparatus" in the drilling system 180 of figure 8 and illustrated for example in the pulse transmitted containing the odd harmonics of inherently noise as indicated in the pulse waveform of figure 7-B.

As to claim 4, Leggett et al., discloses the limitation step "of computing a frequency dependence is carried out by cross correlation analysis" in the drilling system

using computer steps on the BHA and computer computations for methods to include time correlation techniques and result in the deconvolution of the composite waveform to obtain the signal component 154 and the noise component 174 as illustrated in FIG. 7e. Regardless of the method selected, the composite waveform is first digitized by using the previously mention A/D converters and then transferred to the downhole computer 50 for processing. Processing further includes the determination of the amplitudes and arrival times of the P and S wave components from which formation porosity, rock mechanical properties, and other previously discussed parameters of interest are determined. Once computed, the parameters of interest are transmitter to the surface by using the link telemetry path 27 or stored within the downhole storage 46 for subsequent retrieval as disclosed in lines 1-10 of column 14.

As to claim 5, Leggett et al., discloses the limitation of at least one "receiver signal comprises a direct formation signal and formation surrounds said borehole" in the drilling system 22 of figure 8 using the received signal 190 direct from the formation 186 surrounding the borehole 14 in figure 8.

As to claim 6, Leggett et al., discloses the limitation of at least one "receiver signal is a reflected signal and said formation is ahead of the borehole" as illustrated in the drilling system 22 of figure 8 using the reflected signal 192 and looking ahead of the formation 186 in the borehole as illustrated in figure 8.

As to claim 7, Leggett et al., discloses the limitation of "the frequency dependent characteristic is amplitude attenuation" in the drilling system 22 of figure 8 and in line 6 of column 14.

As to claim 8, Leggett et al., discloses the limitation of "the formation property is pore pressure" in the drilling system 22 of figure 8.

As to claim 9, Leggett et al., discloses the limitation of "the pore pressure is estimated from a frequency dependent attenuation relationship" in the drilling system 22 of figure 8.

As to claim 10, Leggett et al., discloses the limitation of "the frequency dependent characteristics is wave propagation velocity" in the drilling system 22 of figure 8 and teaches the velocity and time measurements and porosity computed from these measurements in lines 15-25 of column 1.

As to claim 11, Leggett et al., discloses the limitation of "the formation property is pore pressure" in the drilling system 22 of figure 8 and teaches The parameters of interest that can be provided by the disclosed MWD full wave acoustic system include formation evaluation parameters such as porosity. Additional parameters of interest include Poisson's ratio, elastic moduli, and other mechanical properties of the formation. In addition, integrated travel times over large vertical intervals can be measured disclosed in line 32-40 of column 6.

As to claim 12, Leggett et al., discloses the limitation of "the formation property is lithology" in the drilling system 22 of figure 8 and teaches additional parameters of interest that include the "Lithology" of the formation in line 35 of column 6.

As to claim 13, Leggett et al., discloses the limitation of "the formation property is fluid content" in the drilling system 22 of figure 8 including the requisite "parameters of interest" that encamp the boundary of "fluid content" in line 45 of column 6.

As to claim 14, Leggett et al., discloses the limitation of "the formation property is rock strength" in the drilling system 186 of figure 8 including the requisite "parameters of interest" that encamp the boundary of "rock strength" or the elastic moduli of the rock formation in line 45 of column 6.

As to claim 15, Leggett et al., discloses the limitation of "the BHA is apportion of a measuring while logging system" in the drilling system 22 of figure 8.

As to claim 16, Leggett et al., discloses the limitation of "the source signal is generated by an active source on said BHA" in the drilling system 22 of figure 8.

As to claim 17, MacDonald et al., discloses the limitation of the "determining frequency dependence is carried out by a frequency component analysis" in the drilling system 22 of figure 8 with the surface computer 32 in figure 1.As mentioned previously, the current invention comprises a downhole computer which reduces the raw data to parameter of interest, the volume of which does not exceed current MWD storage and telemetry capacity. Even though downhole processing is provided, parameters of interest must be selected judiciously. As an example, sufficient raw data and sufficient computing power exists to generate a three dimensional map in the vicinity of the drill bit of all geological structures which exhibit an acoustic impedance. It should be recalled that borehole acoustic devices as well as seismic operations respond to changes in acoustic impedance, where acoustic impedance of a material is defined as the product of the density of the material and the velocity of acoustic energy within the material. It would not be possible to telemeter or store a high resolution, three-dimensional tabulation of coordinates of the impedance interface surfaces because of limitations of

current MWD telemetry systems and storage capacities. It is, however, possible to telemeter or store some information concerning the detected interfaces such as the distance to the nearest interface, coarse coordinates of the interfaces, and the like as taught in lines 1-16 of column 6.

As to claim 18, MacDonald et al., discloses the limitation of "the one receive signal comprises a direct borehole signal" in the drilling system 22 of figure 6.

As to claim 19, MacDonald et al., discloses the limitation of "the formation property is permeability" 148 in the drilling system 22 of figure 6.

With regard to claim 20, the arguments applied to claims 1-19 above are applied to claim 20 for their common features. Leggett et al., further teaches a MWD drilling system of drilling and continuously monitoring the parameters of interest including the formation pore pressures and further discloses disclose the limitations for,

a. "Generating a source signal from a bottom hole assemble" in the MWD drilling system 22 of figure 8 and discloses generating a source signal traveling the ray path 190 in figure 8 and in line 43 of column 8, and further discloses the generation of signals 180 by the firing of the transmitter to generate source signals in lines 1-65 of column 13 and column 14 using the BHA 22 in lines 38-43 of figure 8 and,

b. Further discloses the limitation of "detecting at least one receiver signal using said bottom hole assembly" in the drilling system 22 of figure 8 and discloses receiving and detecting a source signal 190 in figure 8 and discloses the receiving of signals using the analog digitized receiver circuits on the subassembly BHA 22 in lines 25-45 of column 12. And,

c. Further discloses the limitation of "using said source and receiver signal to estimate a pore pressure of a formation by using the BHA 22 of figure 8 found on the drilling system of figure 8 using the measured composite waveforms in line 62 of column 13 with computations of time correlation techniques and the deconvolution of the composite waveform to obtain the signal frequency component 154 in lines 60-67 of column 13 and in lines 1-10 of column 14 and discloses the downhole computer 50 on the BHA for data processing of the P and S wave components that determine the formation porosity and other parameters of interest are determined and computed in lines 5-10 in column 14. And,

d. Further discloses the limitation "of repeating steps a), b), c), as said BHA moves sequentially downward through said formations" in the BHA 22 in figure 8 in combination with the drilling and the top side processor 32 in figure 6 to direct the drilling and measures the "parameters of interest" used to direct the drilling and measurements from top side 36 of figure 1.

With regard to claim 21, the arguments applied to claims 1-20 above are applied to claim 21 for their common features. Leggett et al., teaches a MWD drilling system with the integrated bottom hole assembly utility bottom hole assembly 22 containing sensors 199 and transmitter sources 180 in figure 8 for measuring parameters of interest used to compute borehole conditions top side 32 and control the MWD device 36 in the borehole 14 of figure 1. And further discloses,

a. "Generating a source signal from a bottom hole assemble" in the MWD drilling system 22 of figure 8 and discloses generating a source signal traveling the ray path

190 in figure 8 and in line 43 of column 8, and further discloses the generation of signals 180 by the firing of the transmitter to generate source signals in lines 1-65 of column 13 and column 14 using the BHA 22 in lines 38-43 of figure 8 and,

b. Further discloses the limitation of "detecting at least one receiver signal using said bottom hole assembly" in the drilling system 22 of figure 8 and discloses receiving and detecting a source signal 190 in figure 8 and discloses the receiving of signals using the analog digitized receiver circuits on the subassembly BHA 22 in lines 25-45 of column 12. And,

c. Further discloses the limitation of "using said source and receiver signal to determine a pore pressure of a formation by using the BHA 22 of figure 8 found on the drilling system of figure 8 and using the measured composite waveforms in line 62 of column 13 with computations of time correlation techniques and the deconvolution of the composite waveform to obtain the signal frequency component 154 in lines 60-67 of column 13 and in lines 1-10 of column 14 and discloses the downhole computer 50 on the BHA for data processing of the P and S wave components that determine the formation porosity and other parameters of interest are determined and computed in lines 5-10 in column 14. And,

d. Further discloses the limitation of "using the pore pressure to monitor the wellbore safety margin disclosed in topside computations in the processor 32 of figure 1 that control the drilling of the wellbore 14 in figure 1.

e. Further discloses the limitation "of repeating steps a), b), c), and d) as said BHA moves sequentially downward through said formations" using the BHA 22 in figure

8 in combination with the drilling and the top side processor 32 in figure 6 to direct the drilling and measures the "parameters of interest" used to direct the drilling and measurements from top side 36 of figure 1.

With regard to claim 22, the arguments applied to claims 1-21 above are applied to claim 22 for their common features. Leggett et al., teaches a MWD drilling system with the integrated bottom hole assembly utility bottom hole assembly 22 containing sensors 199 and transmitter sources 180 in figure 8 for measuring parameters of interest used to compute borehole conditions top side 32 and control the MWD device 36 in the borehole 14 of figure 1 and further control parameters of MWD including the drilling mud parameters. And further discloses,

a. "Generating a source signal from a bottom hole assemble" in the MWD drilling system 22 of figure 8 and discloses generating a source signal traveling the ray path 190 in figure 8 and in line 43 of column 8, and further discloses the generation of signals 180 by the firing of the transmitter to generate source signals in lines 1-65 of column 13 and column 14 using the BHA 22 in lines 38-43 of figure 8 and,

b. Further discloses the limitation of "detecting at least one receiver signal using said bottom hole assembly" in the drilling system 22 of figure 8 and discloses receiving and detecting a source signal 190 in figure 8 and discloses the receiving of signals using the analog digitized receiver circuits on the subassembly BHA 22 in lines 25-45 of column 12. And,

c. Further discloses the limitation of "using said source and receiver signal to determine a pore pressure of a formation by using the BHA 22 of figure 8 found on the

drilling system of figure 8 and using the measured composite waveforms in line 62 of column 13 with computations of time correlation techniques and the deconvolution of the composite waveform to obtain the signal frequency component 154 in lines 60-67 of column 13 and in lines 1-10 of column 14 and discloses the downhole computer 50 on the BHA for data processing of the P and S wave components that determine the formation porosity and other parameters of interest are determined and computed in lines 5-10 in column 14. And,

d. Further discloses the limitation of "using the pore pressure to monitor the wellbore safety margin disclosed in topside computations in the processor 32 of figure 1 that control the drilling of the wellbore 14 in figure 1.

As to claim 23 Leggett et al., further discloses estimating formation property in the parameters of interest that comprise several geological wellbore parameters 32 in figure 1.

As to claim 24 Leggett et al., further discloses the value is bases on the measured "parameters of interest" including and encamping several characteristics of measured frequencies in the computational data processes 32 in figure 1 in combination with the complete patent.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Victor J. Taylor whose telephone number is 571-272-2281. The examiner can normally be reached on 8:00 to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John E. Barlow can be reached on 571-272-2863. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

VJT
18 June 2005.

John Barlow
Supervisory Patent Examiner
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